Name: Key

FO-2133 Forest Measurement
Exam 1 - 2008

Given the partial computations below,

1. fill in the missing data elements (45 points)
2. complete the regression computations for the model: $DBH_{ob} = b_0 + b_1 (DBH_{ib}) + \epsilon_i$ (20 points)

Tree#	$DBH_{current}$	1X-Bark	$DBH_{ib,current}$	1X-RG10	$DBH_{ib,past}$	$DBH_{ob,past}$	DBH Growth
1	5.9	0.8	4.3	0.20	3.9	5.5	0.4
2	6.9	0.9	5.1	0.23	4.6	6.4	0.5
3	7.5	1.0	5.5	0.25	5.0	6.8	0.7
4	8.0	1.1	5.8	0.23	5.3	7.2	0.8
5	8.8	1.0	6.8	0.30	6.2	8.3	0.5
6	9.4	1.1	7.2	0.32	6.6	8.7	0.7
7	10.0	1.1	7.8	0.33	7.1	9.4	0.6
8	10.9	1.3	8.3	0.33	7.6	10.0	0.9
9	11.9	1.4	9.1	0.40	8.3	10.8	1.1
10	12.3	1.4	9.5	0.44	8.6	11.2	1.1
Sum	**91.6**		**69.4**				
Mean	**9.16**		**6.9**				

(15)

Tree#	X	Y	X^2	Y_2	XY	$\hat{Y}$	$(Y_i - \hat{Y}_i)^2$
1	4.3	5.9	18.49	34.81	25.37	5.95	0.0021
2	5.1	6.9	26.01	47.61	35.19	6.92	0.0004
3	5.5	7.5	30.25	56.25	41.25	7.41	0.0087
4	5.8	8.0	33.64	64.00	46.40	7.77	0.0520
5	6.8	8.8	46.24	77.44	59.84	8.99	0.0359
6	7.2	9.4	51.84	88.36	67.68	9.48	0.0059
7	7.8	10.0	60.84	100.00	78.00	10.21	0.0429
8	8.3	10.9	68.89	118.81	90.47	10.82	0.0071
9	9.1	11.9	82.81	141.61	108.29	11.79	0.0121
10	9.5	12.3	90.25	151.29	116.85	12.28	0.0005
Sum	**69.4**	**91.6**	**509.26**	**880.18**	**669.34**		**0.1676**
Mean	**6.9**	**9.2**					

(20)

(10)

CSS		**27.624**	**41.124**	**33.636**
b_1	1.2176			
b_0	0.7096			
I^2	0.9959			
$s_{y.x}$	0.1447			

(5) $= \frac{33.636}{27.624}$

(5) $= 9.16 - 1.2176(6.9)$

(5) $= 1 - \frac{0.1676}{41.124}$

(5) $= \sqrt{\frac{0.1676}{8}}$

3. The resulting regression equation is: $DBH_{ob} = 0.7096 + 1.2176(DBH_{ib})$ (5 points)

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4. The quadratic mean DBH of the 10 sample trees is: 9.38 inches (5 points)

$DBH_{qm} = \sqrt{\frac{880.18}{10}} =$

5. If the 10 sample trees above were measured on a 0.1 acre plot , the estimated mean basal area per acre would be: 48 square feet per acre (5 points)

$BA/plot = (.005454)(880.18) = 4.8$ sq ft

$BA/acre = (4.8\ ft^2)/0.1 = 48$ sq ft/ac

6. For the 10 sample trees above, the descriptive statistics for $DBH_{current}$ are:

A. Variance $(s^2) =$ 4.569 (5 points)

$s^2 = \frac{CSS_y}{n-1} = \frac{41.124}{9}$

B. Standard deviation $(s) = \sqrt{4.569} = 2.138$ (5 points)

C. Standard error of the mean $(s_{\bar{x}}) = \sqrt{\frac{4.569}{10}} = 0.676$ (5 points)

D. Coefficient of variation $(CV\%) = \frac{2.138}{9.16} \times 100 = 23.3\%$ (5 points)

Formulae:

$$s^2 = \frac{\left[\sum_{i=1}^{n} x_i^2 - \frac{(\sum_{i=1}^{n} x_i)^2}{n}\right]}{(n-1)} \qquad s^2 = \frac{\left[\sum_{i=1}^{n} x_i^2 - \bar{x}\sum_{i=1}^{n} x_i\right]}{(n-1)}$$

$$s = \sqrt{s^2} \qquad s_{\bar{x}} = \sqrt{\frac{s^2}{n}(1 - \frac{n}{N})}$$

$$\bar{x} \pm (t_{\alpha,\, n-1})s_{\bar{x}} \qquad SE\% = \left(\frac{t_{\alpha,\, n-1}\, s_{\bar{x}}}{\bar{x}}\right)100\%$$

$$CV\% = \left(\frac{s}{\bar{x}}\right)(100)$$

$$CSS_y: \sum y^2 = \sum Y^2 - \frac{(\sum Y)^2}{n}$$

$$CSS_x: \sum x^2 = \sum X^2 - \frac{(\sum X)^2}{n}$$

$$CSP_{xy}: \sum xy = \sum XY - \frac{\sum X \sum Y}{n}$$

$$b_1 = \frac{\sum xy}{\sum x^2} = \frac{CSP_{xy}}{CSS_x} \qquad b_0 = \bar{Y} - b_1\bar{X}$$

$$TotalSS = CSS_y = \sum y^2 \qquad RegSS = \frac{(CSP_{xy})^2}{CSS_x} = \frac{(\sum xy)^2}{\sum x^2} = b_1 \sum xy$$

$$ErrorSS = \sum (Y - \hat{Y})^2$$

$$I^2 = \left(1 - \frac{Error\ SS}{Total\ SS}\right)$$

$$S_{y.x} = \sqrt{\frac{\sum (Y-\hat{Y})^2}{n-2}} = \sqrt{\frac{ErrorSS}{n-2}}$$